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St. Paul's Hospital Millennium Medical College

**PATTERNS AND ASSOCIATED FACTORS OF KNEE JOINT
ABNORMALITIES DETECTED BY KNEE MRI IN PATIENTS
EVALUATED AT ST PAUL'S MILLENNIUM MEDICAL
COLLEGE, ADDIS ABABA, ETHIOPIA: A ONE YEAR
RETROSPECTIVE STUDY**

INVESTIGATOR: DR. MOHAMMED ADEM (MD, RADIOLOGY RESIDENT)

A RESEARCH THESIS SUBMITTED TO THE RADIOLOGY DEPARTMENT OF ST PAUL'S MILLENNIUM MEDICAL COLLEGE IN PREPARATION FOR PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE POST GRADUATE STUDY COMPLETION IN RADIOLOGY.

ADDIS ABABA, ETHIOPIA

JUNE, 2024

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ADVISORS: DR. SHEWALEM NEGASH (Radiologist, MSK sub specialist)

BIZATU MENGISTIE (PhD, Associate professor)

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JUNE, 2024

St. Paul's Hospital Millennium Medical College

Graduate study program

Name of investigator	Dr Mohammed Adem (Radiology Resident)
Full title of the research project	Patterns and associated factors of knee joint abnormalities detected by knee MRI in patients evaluated at St Paul's Millennium Medical College, Addis Ababa, Ethiopia.
Study Duration	April 2024 - June 2024
Study Area	St. Paul's Hospital Millennium Medical College
Total Cost of the project	27,840 Birr
Source(s) of Funding	St. Paul's Hospital Millennium Medical College
Address of investigator	Tel-0922900257 Email-mohaadem771@gmail.com
Name of Advisor(s)	Dr .Shewalem Negash (Radiologist, MSK sub specialist.) Bizatu Mengistie (PhD Associate professor)

ABSTRACT

Background: Magnetic resonance imaging (MRI) has emerged as an invaluable tool for accurately visualizing and detecting knee joint abnormalities such as ligament tears, meniscal tears, cartilage defects, osteoarthritis, tendinopathies, and joint effusions. However, there is a paucity of data regarding the patterns and prevalence of knee joint abnormalities detected by MRI among patients at St. Paul's Millennium Medical College in Addis Ababa, Ethiopia.

Objective: To investigate the patterns and associated factors of knee joint abnormalities detected by MRI among patients evaluated at St. Paul's Millennium Medical College.

Method: Hospital-based cross-sectional study was conducted. The study populations comprised patients referred for knee Magnetic Resonance Imaging during the study period who meet the inclusion criteria. A simple random sampling technique was used to select the 204 patients. Data was collected by reviewing patient charts, MRI images, and reports using data extraction tool. Findings were analyzed using SPSS version 27 software to determine the pattern of abnormalities, assess associated demographic/clinical factors, evaluate distribution patterns in anatomical structures, and investigate influences of concomitant abnormalities.

Result: A total of 204 patients were included in the study of which 113 (55.4%) were males and 91 (44.6%) were females. In this study, 177 (86.8%) had a knee joint abnormality detected by MRI. Age <30 years (AOR=0.219 95%CI=0.064-0.742), History of trauma (AOR=4.351 95%CI=1.58-12.009), and Identified comorbidity (AOR=2.175 95% CI=1.042-7.632) were significantly associated with knee joint abnormality detected by Magnetic Resonance Imaging.

Conclusion and recommendation: Age, history of trauma, and presence of identified comorbidities were major predictors of knee joint abnormalities. From those who have ligament abnormality ACL tear was the most common in our study. Joint effusion was the most common abnormality detected by MRI followed by cartilage abnormality, osteophyte, and subchondral cyst. We advise hospitals to create clear procedures to make justified use of these costly and scarce resources.

Key words: Magnetic resonance imaging, knee joint abnormalities, Ethiopia

ACCRONYMS

ACL - Anterior Cruciate Ligament

CTA - Computed Tomography Arthrography

GP - General Practitioner

IQR- Inter Quartile Ratio

LCL - Lateral Collateral Ligament

LM - Lateral Meniscus

MCL - Medial Collateral Ligament

MFL - Medial Patellofemoral Ligament

MM - Medial Meniscus

MRA - Magnetic Resonance Arthrography

MRI - Magnetic Resonance Imaging

MSK - Musculoskeletal

MTL - Medial Patellotibial Ligament

NPV - Negative Predictive Value

PCL - Posterior Cruciate Ligament

PFJ - Patellofemoral Joint

PLC - Posterolateral Corner

PPV - Positive Predictive Value

SPHMMC - St. Paul's Hospital Millennium Medical College

SPSS - Statistical Package for the Social Sciences

TFJ-Tibiofemoral Joint

T- Tesla (MRI magnetic field strength)

T1W- T1 weighted image (T- a measure of time, longitudinal relaxation time)

T2W- T2 weighted image (T- a measure of time, Transverse relaxation time)

ACKNOWLEDGEMENTS

Special thanks to St. Paul millennium medical college and department of radiology and MRT.

I would like to express my sincere gratitude to all of my advisors for their invaluable advice and expertise during the development of my research thesis. Their invaluable contributions have been highly valuable in the formation of this research thesis and I am extremely thankful for their help. My gratitude goes to all my colleagues and friends for their fruitful inputs and suggestion. I salute you, all those who contributed to this research directly and indirectly.

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1. INTRODUCTION

1.1 Background

Knee joint is a complex and intricate structure that plays a crucial role in facilitating mobility, weight-bearing, and overall quality of life. It consists of an intricate network of bones, cartilage, ligaments, tendons, and other soft tissues that work in harmony to enable a wide range of movements, including flexion, extension, and rotation. [1] However, due to its complexity and the substantial forces it withstands during daily activities, the knee joint is susceptible to various abnormalities and injuries. [2]

These abnormalities can arise from a myriad of factors, including acute trauma, chronic overuse, degenerative processes, inflammatory conditions, or congenital defects. Common knee joint pathologies encompass conditions such as ligament tears (e.g., anterior cruciate ligament (ACL) or medial collateral ligament (MCL) injuries), meniscal tears, cartilage defects, osteoarthritis, tendinopathies, and joint effusions, among others. [2]

Magnetic Resonance Imaging (MRI) has emerged as an invaluable diagnostic tool in the evaluation of knee joint abnormalities. Its ability to provide detailed, high-resolution images of the internal structures without the use of ionizing radiation has revolutionized the field of musculoskeletal radiology. MRI not only allows for the accurate visualization of bones and soft tissues but also enables the detection of subtle changes, such as early cartilage degeneration or small tears that may be challenging to identify with other imaging modalities. [3]

1.2 Statement of the Problem

Musculoskeletal disorders, particularly those affecting the knee joint, pose a significant burden on individuals and healthcare systems worldwide. With the rising prevalence of knee joint abnormalities due to factors such as aging populations, sedentary lifestyles, and sports-related injuries, the accurate and timely diagnosis of these conditions is crucial for effective treatment and improved patient outcomes. Magnetic Resonance Imaging (MRI) has emerged as a powerful diagnostic tool for detecting various knee joint abnormalities with high precision and detail, offering valuable insights into the structural integrity and pathologies of the knee.

The detection and understanding of patterns of knee joint abnormalities on MRI scans present a critical healthcare challenge on a global scale. The prevalence of knee joint abnormalities not only impacts the health outcomes and quality of life of individuals worldwide but also underscores the disparities in healthcare access and resources faced by populations in diverse regions. Several studies have documented various knee joint abnormalities, such as osteoarthritis, meniscal tears, ligament injuries, and bone tumors, in different populations worldwide. However, the prevalence, distribution, and characteristics of these abnormalities may vary depending on factors such as genetics, lifestyle, and environmental factors. [23]

In the Ethiopian context, limited access to advanced diagnostic technologies and specialized healthcare services further exacerbates the burden of knee-related conditions, leading to delayed diagnosis, suboptimal treatment, and compromised patient outcomes.

At St. Paul's Millennium Medical College in Addis Ababa, there is a paucity of data regarding the patterns and prevalence of knee joint abnormalities detected by MRI among patients seeking medical attention. This lack of information poses significant challenges in developing tailored diagnostic and treatment strategies that address the specific needs of the local population.

Furthermore, the absence of comprehensive data on the common knee joint pathologies encountered in this setting hinders the optimization of resource allocation and the effective training of healthcare professionals. Without a clear understanding of the prevalent conditions, it becomes challenging to prioritize the acquisition of specialized equipment, develop targeted educational programs, and allocate human resources effectively. [24]

1.3 Significance of the Study

The study on the patterns of knee joint abnormalities detected on MRI scans at St. Paul Millennium Medical College holds significant importance for various stakeholders within the healthcare domain.

1. Clinical Impact: Understanding the specific patterns of knee joint abnormalities through MRI imaging can enhance the accuracy of diagnosis and treatment planning for patients presenting with knee-related conditions. This knowledge can lead to more targeted and effective interventions, ultimately improving patient outcomes and quality of care.

2. Research Contribution: The study contributes to the existing body of knowledge in the field of musculoskeletal imaging, particularly in the context of knee joint abnormalities. By identifying common patterns and variations in abnormalities detected on MRI scans, the research can provide valuable insights for future studies and clinical practice.

3. Educational Value: The findings of the study can be utilized for educational purposes, including training programs for healthcare providers and medical students. Understanding the nuances of knee joint abnormalities can help in the development of educational materials and resources that enhance the learning experience of healthcare professionals.

4. Healthcare Planning and Policy: Insights gained from the study can inform healthcare planning and policy-making at St. Paul Millennium Medical College and beyond. By identifying prevalent patterns of knee joint abnormalities, healthcare facilities can optimize resource allocation, prioritize areas of need, and implement targeted interventions to address the specific healthcare challenges related to knee disorders.

5. Global Relevance: The study's findings may have broader implications beyond the local context, contributing to the global understanding of knee joint abnormalities and facilitating the exchange of knowledge.

In summary, the study on the patterns of knee joint abnormalities detected on MRI at St. Paul Millennium Medical College has the potential to make significant contributions to clinical practice, research, education, healthcare planning, and the global discourse on musculoskeletal imaging and knee health.

2. LITERATURE REVIEW

2.1 Sociodemographic factors and common types Knee Joint Abnormalities:

Population-based surveys have shed light on the burden of knee joint disorders across various regions and demographics. According to a study conducted in Netherland, the overall incidence of knee pain was found to be 15.2%, with low back pain ranking second at 26.9%, followed by neck pain at 20.6%, and shoulder pain at 2.0%. Significantly, it is worth noting that 30% of the patients surveyed experienced varying levels of restriction in their daily activities, thereby underscoring the functional implications associated with disorders in the knee joint [4]. Osteoarthritis was found to be the most common cause of knee pain, according to the findings of the German SESAM 2 study. Patients coming to their general practitioners (GPs) with knee pain were almost equally represented by females (50.4%) and males (49.6%). The age range of 45 to 64 years exhibited the highest prevalence of knee pain [5]. On the contrary, the Dutch Transition Project study, which was conducted in a different general practice setting, observed that a greater proportion of female patients (53.8%) sought consultation with their GP regarding knee pain. Additionally, the research unveiled that recent knee pain was more prevalent among males aged 15 to 44 years. In contrast, women experienced the onset of knee pain more frequently than men between the ages of 65 and 74, and again more frequently around the age of 75 [5]. These findings underscore the potential influence of age and gender on the patterns of knee joint abnormalities.

The study conducted in Norway by Hunt examined the prevalence of chronic musculoskeletal pain at different anatomical regions of the body over a period of one year. The findings revealed an overall prevalence rate of 44.6%. Knee pain exhibited a prevalence rate of 12.8%, ranking fourth among pain types such as shoulder, neck, and lower back pain. The incidence of knee pain exhibited a positive correlation with advancing age, reaching its peak among individuals aged 80 years and older for both genders [6]. Nevertheless, in a comparable investigation carried out in the United Kingdom, the knee was found to be the second most common source of pain (19.6%), following the back (26.4%). Furthermore, the level of physical weakness tends to worsen as individuals age [7]. These variations in prevalence and ranking across different populations highlight the need for region-specific assessments to inform tailored interventions.

Population-based surveys indicate a greater prevalence of knee disease compared to studies conducted in primary care settings, which indicate a lower rate of medical care seeking among individuals experiencing knee pain.

In a study conducted at South Africa total of 72 patients were analyzed. The median age was 35 years (IQR 26 – 43) with a significant difference between males and females (28 vs. 41 years, $p = 0.0019$). Leading causes of injury were traffic accidents (32.4%), falls (27.0%) and sports injuries (17.6%). Median interval from MRI to surgery was 71.5 days (IQR 29 – 143). The sensitivity of MRI for ACL, MM and LM injuries was (63.6%, 58.8% and 52.6%), specificity (92.7%, 86.0% and 80.0%) and diagnostic accuracy (79.7%, 79.7% and 73.0%) respectively. [25]

In a similar study done at Nigeria, there were 158 participants comprising 92 males (58.2%) and 66 females (41.8%) between the ages of 18 and 79. The mean age of the males was 44.75 ± 14.41 years, while that of the females was 47.76 ± 13.72 years ($P = 0.19$). A history of previous trauma was elicited in 135 (85.4%) participants. Eighty-two right knees (51.9%) and 76 left knees (48.1%) were examined. The dominant joint pathologies detected include effusion (77.2%), medial meniscopathy (48.1%), tibial abnormalities (46.2%), femoral abnormalities (46.2%), patella abnormalities (46.2%), anterior cruciate ligament disorders (37.3%), lateral meniscopathy (27.2%), medial collateral ligament disorders (22.2%), and popliteal (Baker's) cysts (15.8%). ACL abnormalities were significantly more prevalent in male subjects. Knees with ruptured sACL had significantly more joint effusion and injuries to the medial meniscus, lateral meniscus, posterior cruciate ligament (PCL), medial retinacular ligament (MRL), femur, tibia, and fibula. There was no significant difference in the frequency of abnormalities between the right and left knees. [26]

Finally, in a research conducted in Ethiopia at Tikur anbesa hospital, A total of 49 patients were included in the study out of which 26(53.1%) were male and 23 (46.9%) were female, with a mean age of 43 years (range 17 to 68 years). The three most common pathologies were joint effusion seen in 32(65.3%), bone marrow edema in 22(45.8%) and osteophytes in 22(44.9%). ACL tear was the commonest ligament abnormality occurring in 5 (10.4%) patients. Ten (20.8%) patients had meniscal tear, all involving the medial meniscus with the posterior horn being involved in 8(80%) of these patients. [27]

2.2 specific knee joint abnormalities detected by MRI

Numerous studies have compared specific knee joint abnormalities detected by MRI.

2.2.1 Meniscal Injuries:

Orlando et al. determined that MRI showed high sensitivity (92%), specificity (74%), and accuracy (83%) for meniscal medial (MM) injuries, outperforming clinical examination in terms of sensitivity, specificity, and accuracy for MM injuries [8]. Chandru et al. reported that MRI had high sensitivity (92%), but lower specificity (56%) and accuracy (70%) for MM injuries compared to clinical examination [9]. Puri et al. found that MRI had better sensitivity (95% vs. 85%) and specificity (100% vs. 50%) than clinical examination in diagnosing MM injuries [10]. Singh et al. reported that MRI had a high negative predictive value (NPV) of 81% for MM injuries, indicating its usefulness in ruling out pathologies [11].

Regarding lateral meniscal (LM) injuries, Chandru et al. reported that MRI had a sensitivity of 63%, specificity of 73%, and accuracy of 70% [9]. Krakowski et al. found that MRI and clinical examinations had comparable sensitivities and specificities for LM injuries [12]. A systematic review by Crawford et al. revealed that MRI displayed a higher specificity (93%) than sensitivity (76%) and a higher NPV (80%) than positive predictive value (PPV) (92%) for LM tears [13]. Smet et al. observed that the presence of an anterior cruciate ligament (ACL) tear decreased the sensitivity of detecting LM tears from 94% to 69% on MRI [14].

Overall, the literature suggests that MRI generally outperforms clinical examination in terms of sensitivity and NPV for MM injuries, while the diagnostic performances for LM injuries are more comparable between the two modalities. However, there is some variability in the reported metrics across studies.

2.2.2 Cruciate Ligament Injuries:

For ACL injuries, Orlando et al. found that MRI had high sensitivity (87%), specificity (74%), and accuracy (83%) [8], while Chandru et al. reported high sensitivity (95%), specificity (88%), and accuracy (93%) of MRI [9]. Sindhura et al. observed that MRI had higher sensitivity (100% vs. 83%) than clinical examination in identifying complete ACL tears and a high NPV of 100%

for complete ACL tears [15]. Krakowski et al. reported that MRI had a lower sensitivity (75%) than clinical examination for identifying ACL tears [12].

Regarding posterior cruciate ligament (PCL) injuries, Singh et al. found that MRI had a high NPV of 90% [11], while Dave et al. reported that MRI had a higher sensitivity (63% vs. 0%) and lower missed diagnosis rate (38% vs. 100%) for complete PCL tears compared to incomplete PCL injuries [16].

These findings suggest that MRI generally exhibits high sensitivity and NPV for ACL and PCL injuries, making it a valuable tool for ruling out such pathologies. However, there is some variability in the reported metrics across studies, and clinical examination may outperform MRI in certain aspects of ACL tear identification.

2.2.3 Chondral Lesions:

In terms of chondral lesions, Vallotton et al. reported high sensitivity (85%), specificity (97%), PPV (96%), NPV (89%), and accuracy (92%) of MRI for patellar cartilage lesions, comparable to arthroscopy [17]. Drew et al. found that magnetic resonance arthrography (MRA) and computed tomography arthrography (CTA) were superior to MRI in detecting patellofemoral joint (PFJ) chondral lesions, with MRA having a sensitivity of 70% and specificity of 99%, and CTA having a sensitivity of 80% and specificity of 99%. However, MRI had better diagnostic accuracy for tibiofemoral joint (TFJ) chondral lesions, with a sensitivity of 88% and specificity of 82% (20). Figueroa et al. observed that MRI had low sensitivity (45%) but high specificity (100%) for detecting chondral lesions, with the best accuracy for patellar defects [18].

These findings suggest that MRI may have limitations in detecting certain types of chondral lesions, particularly in the PFJ, and that alternative imaging modalities such as MRA and CTA may be more appropriate in certain cases.

2.2.4 Other Knee Joint Abnormalities:

Bonadio et al. evaluated posterolateral corner (PLC) knee injuries and found that MRI had low sensitivity for detecting lateral collateral ligament (58%) and popliteus musculotendinous (24%) lesions, suggesting that MRI should not be used alone for diagnosing PLC injuries [19].

2.3 Association with Demographic and Clinical Factors

Several demographic and clinical factors have been explored in relation to knee joint abnormalities. For instance, age has been identified as a significant risk factor for meniscal tears and cartilage lesions [28]. Gender differences have also been observed, with higher rates of ACL tears in females [29]. Moreover, a history of knee injuries, such as previous ligamentous tears or meniscal injuries has been associated with an increased risk of developing knee joint abnormalities [23].

The prevalence of a meniscal tear or of meniscal destruction in the right knee as detected on MRI ranged from 19% (95% confidence interval [CI], 15 to 24) among women 50 to 59 years of age to 56% (95% CI, 46 to 66) among men 70 to 90 years of age;

Among persons with radiographic evidence of osteoarthritis, the prevalence of a meniscal tear was 63% among those with knee pain, aching, or stiffness on most days and 60% among those without these symptoms [30]

The prevalence and severity of knee lesions was positively associated with BMI, with a nearly fourfold increase in meniscal tears and more than twofold increase in high-grade cartilage defects in obese individuals relative to normal-weight subjects [31]

The overall literature review highlights that knee joint abnormalities detected by knee MRI are prevalent and contribute to knee pain and disability in various populations. Meniscal tears, articular cartilage defects, and ligamentous injuries are commonly observed patterns of knee joint abnormalities. Demographic factors such as age and gender, as well as a history of knee injuries, have been associated with an increased likelihood of developing knee joint abnormalities. Understanding these patterns and associated factors is crucial for accurate diagnosis, appropriate treatment planning, and improved patient outcomes.

2.3 Conceptual framework

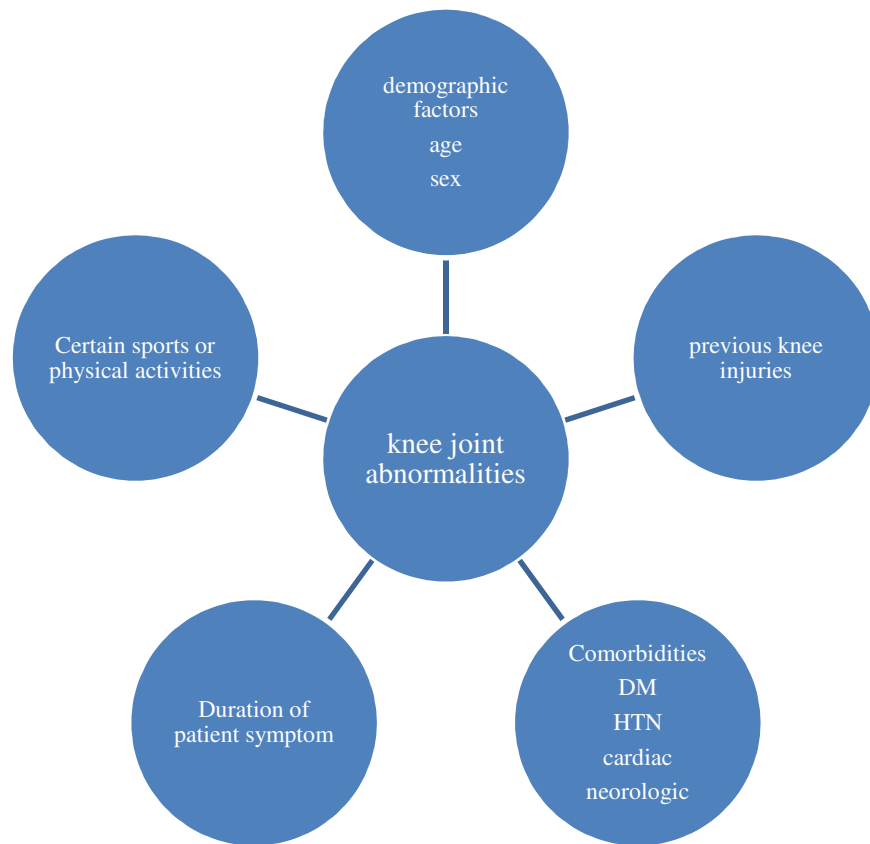


Figure 1 A conceptual framework of the patterns of knee joint abnormalities detected on MRI at St. Paul millennium medical college, Addis Ababa, Ethiopia, 2024 made after reviewing different literatures.

3. OBJECTIVES

3.1 General Objective:

- To investigate the patterns and associated factors of knee joint abnormalities detected by magnetic resonance imaging (MRI) among patients evaluated at St. Paul's Millennium Medical College in Addis Ababa, Ethiopia from May 2024 -June 2024.

3.2 Specific Objectives:

- To determine the socio demographic distribution of patients with knee abnormalities detected on knee MRI done during the study period.
- To assess the common types of knee abnormalities detected on knee MRI during the study period
- To identify associated factors of knee joint abnormalities detected on knee MRI during the study period

4. METHODS AND MATERIALS

4.1 Study area

The study was conducted in Saint Paul hospital millennium medical college, Addis Ababa, which is second main government owned referral center. The college has more than 2,800 clinical, academic and administrative and support staff that provide medical specialty services to patients who are referred from all over the country, teaching medicine and nursing students and doing basic and applied researches. While the inpatient capacity is more than 700 beds, The College sees an average of 1,200 emergency and outpatient clients daily.

There are approximately 30 knee MRI examinations performed per month at the MRI unit of the Department of Radiology at St. Paul's Millennium Medical College.

4.2. Study design and period

This is a hospital-based cross-sectional study and includes data of patients who had knee MRI during the study period from May 2024-June 2024 at the Department of Radiology, St. Paul's Millennium Medical College Addis Ababa, Ethiopia.

4.3. Populations

4.3.1 Source Populations

The source population comprised data of patients who were referred for MRI evaluation of the knee at the MRI unit of the Department of Radiology at St. Paul's Millennium Medical College during the study period.

4.3.2 Study population

The study population was comprise data of patients who were referred for MRI evaluation of the knee at the MRI unit of the Department of Radiology at St. Paul's Millennium Medical College during the study period and who full fill the inclusion criteria.

4.4. Inclusion and Exclusion criteria

4.4.1. Inclusion criteria

- Data of all patients evaluated with knee MRI during the study period
- MRI data of all patients that is of good imaging quality for making a diagnosis

4.4.2. Exclusion criteria

- Data of all Patients with a history of knee surgery (e.g., prosthesis, ACL reconstruction)

4.5. Sample Size and Sampling Technique

The sample size is determined using the single population proportion formula. The three common factors to be taken into consideration for determining sample size are the level of significance (α), the margin of error (d), and the estimated baseline level, of the indicator to be measured (p). Then, the initial sample size (n_0) is given by

$$n_0 = \frac{z_{\alpha/2}^2 \times p(1-p)}{d^2}$$

Due to unknown prevalence of knee joint abnormalities in our area, the sample size is calculated based on a prevalence of 50% at a 95% confidence level and margin of error of 5 %.

Given- confidence interval = 95% Z= 1.96, P=0.5, W=0.05

Study is about $n_0 = \frac{1.96^2 \times 0.5(1-0.5)}{0.05^2} \approx 384$ since the population size is 360 patients a finite population correction formula was used and the sample size was 185 and by considering a 10 % non-response rate, a sample size of 204 patients was taken.

Since the total population size is 360 and the calculated sample size is 204, a simple random sampling technique was used to select the 204 patients. This was done by assigning a unique identifier (e.g., patient ID) to each of the 360 patients and then using a random number generator to select 204 patients.

4.6. Study Variables

4.6.1. Dependent Variable

- Knee joint abnormalities (YES ,and NO)

4.6.2. Independent Variables

- Sociodemographic variables: age, gender

- History and type of trauma
- Duration of patient symptoms
- Certain sports or physical activities
- Comorbidities

4.7 Materials

Knee images via MRI at St. Paul's Millennium Medical College were obtained using *seimens MRI*. For the examination of the knee, a knee coil is employed; a conventional protocol for knee MR Imaging at SPHMMC are *T1 ,T2 and PD and PD FS MRI sequences*

4.8 Data collection plan and Quality Assurance

Data was extracted using data extraction tool. Patient's charts were identified from the *RIS (Radiology information system), EMR (electronic medical record) and PACS (picture archiving and communication system)* was used to retrieve their imaging. Data collectors were trained about the contents of the questionnaire and to collect the data in an accurate manner. Each paper was checked for completeness using format prepared by reviewing different literatures and undertaking modifications for the population studied.

Using data extraction tool, demographic data of participant patients such as age, gender, and presenting symptoms was collected. The images and imaging reports, which were verified by *fellow MSK radiologists*, were reviewed by the principal investigator. Findings were randomly cross-checked by experienced fellow *MSK radiologists*.

In order to evaluate the clarity of the questionnaire and to assure the data quality, proper designing and pre-testing of the questionnaires were done on 5% of participants.

4.9 Data analysis and interpretation

The collected data was exported to SPSS version 27.0 statistical package for analysis after checking for missing values. Details of data analysis, such as tables and graphs, were used to show demographic data, clinical findings, and MRI findings and patterns. Associations between knee joint abnormalities and demographic or clinical factors were explored using appropriate statistical tests and associations with logistic regression analysis.

4.10 operational definitions

- **Pattern:** specific characteristics or features that are observed in study participants. This may include identifying the location, size, shape, and severity of abnormalities such as tears, fractures, dislocations, or inflammation in the knee joint
- **MRI detection:** refers to the identification and characterization of knee joint abnormalities using magnetic resonance imaging technology. Recognizing and labeling specific abnormalities or pathologies within the knee joint based on visual interpretation of MRI scans by qualified medical professionals.
- **Knee Joint Abnormalities:** Structural or anatomical deviations from the typical or healthy state of the knee joint that can be visualized using magnetic resonance imaging (MRI).
- **History of trauma:** Documented record or account of any physical injury or significant event that has occurred to the patient
- **Symptoms of the patient:** observable or reported signs of discomfort or abnormalities experienced by the patient.

4.11 Ethical considerations

Data collection was done after a formal letter is forwarded, and permission is obtained from the SPHMMC institutional review board. All information obtained was handled confidentially by keeping the anonymity of the study subjects using code numbers on questionnaires during the data collection process.

4.12 Dissemination of results

The findings of this study will be disseminated through the Department of Radiology at St. Paul's Millennium Medical College, the institutional library, and the relevant academic or professional bodies. The results will be presented in SPHMMC and research symposium to give comment on what is currently known and the new findings that our study will provide underling the importance of evidence-based practice.

5. RESULT

5.1. Socio-demographic data

A total of 204 patients were included of these patients, 113 (55.4%) were male and 91 (44.6%) were females. The age was classified in to three groups and out of these >50 years age was the commonest age group consisting of 78 (38.3%) participants. For more see Tables 1.

Table 1: socio-demographic characteristics of the study population knee joint abnormalities detected by knee MRI among patients evaluated at St. Paul's Millennium Medical College in Addis Ababa, Ethiopia, 2024 (N=204)

Variable	Description	Frequency	Percentage (%)
Age	< 30	58	28.4
	30-50	68	33.3
	>50	78	38.2
Sex	Male	113	55.4
	Female	91	44.6

5.2. History of trauma and comorbidities

Out of the 204 patients involved in the study 107 (52.5%), 24(11.8%), and 121 (59.3%) have Hx of trauma, involves in sports, and have identified comorbidities respectively. From those who have comorbidities the most common was DM (41.7%), and from those who involve in sports the most common was football (75%). See table 2

Table 2: history of trauma and comorbidities of knee joint abnormalities detected by magnetic resonance imaging (MRI) among patients evaluated at St. Paul's Millennium Medical College in Addis Ababa, Ethiopia, 2024 (N=204)

Variables	Description	Frequency	Percentage (%)
Hx of trauma	Yes	104	51
	No	100	49
Involve in sports	Yes	24	11.8
	No	180	88.2
Type of sport involved	Football	18	75
	Basketball	6	25
Identified comorbidities	Yes	121	59.3
	No	83	40.7
Type of comorbidity	DM	51	41.7
	HTN	40	33.3
	DM and HTN	30	25

5.3. MRI findings

From the total 204 participants 45 (22.1%), 46 (22.5%), and 7 (3.4%) have bone abnormalities, bone marrow edema and bone fracture respectively. From those who have bone fracture the most common site was femur (57.1%), and from those who have ligament abnormality ACL tear was the most common (55.9%). For more see table 3 below

Table 3: description of knee joint abnormalities detected by magnetic resonance imaging (MRI) among patients evaluated at St. Paul's Millennium Medical College in Addis Ababa, Ethiopia, 2024 (N=204)

Variable	Description	Frequency	Percent (%)
Bone abnormalities	Yes	45	22.1
	No	159	77.9
bone marrow edema	Yes	46	22.5
	No	158	77.5
bone fracture	Yes	7	3.4
	No	197	96.6
site of fracture	femur	4	57.1
	tibia	2	28.6
	tibia patella	1	14.3
soft tissue abnormality	Yes	7	3.4
	No	197	96.6
ligament abnormality	yes	34	16.7
	no	170	83.3
type of ligament abnormality	ACL tear	19	55.9
	MCL tear	4	11.8
	PCL tear	1	2.9
	ACL and PCL tear	4	11.8
	ACL and MCL tear	5	14.7
	ACL and LCL tear	1	2.9
ACL tear specific type	Partial thickness tear	12	38.7
	Full thickness tear	19	61.3
meniscal lesion	yes	78	38.2

		No	126	61.8
medial	meniscal	Grade I	33	53.2
lesion grade		Grade II	20	32.3
		Grade III	9	14.5
lateral	meniscal	Grade I	13	40.6
lesion grade		Grade II	10	31.3
		Grade III	9	28.1
tendon abnormality		yes	10	4.9
		no	194	95.1
joint effusion		yes	90	44.1
		no	114	55.9
osteophyte		yes	48	23.5
		no	156	76.5
subchondral cyst		yes	48	23.5
		no	156	76.5
cartilage		yes	58	28.4
abnormality		no	146	71.6
intra-articular		yes	15	7.4
mass/tumor		no	189	92.6

5.4. Knee joint abnormalities detected by knee MRI

A total of 204 patients were involved in the study and from those 177 (86.8%) have a knee joint abnormality detected by MRI and 27 (13.2%) have no knee joint abnormality detected by MRI.

Knee Joint Abnormalities was defined as any Structural or anatomical deviations from the typical or healthy state of the knee joint that can be visualized using magnetic resonance imaging (MRI). Patients who has Structural or anatomical deviations from the typical or healthy state of the knee joint was categorized in YES and those who don't have in NO.

Table 4: prevalence of knee joint abnormalities detected by magnetic resonance imaging (MRI) among patients evaluated at St. Paul's Millennium Medical College in Addis Ababa, Ethiopia, 2024 (N=204)

Variable	Description	Frequency	Percent (%)
knee joint abnormality detected by MRI	Yes	177	86.8
	No	27	13.2

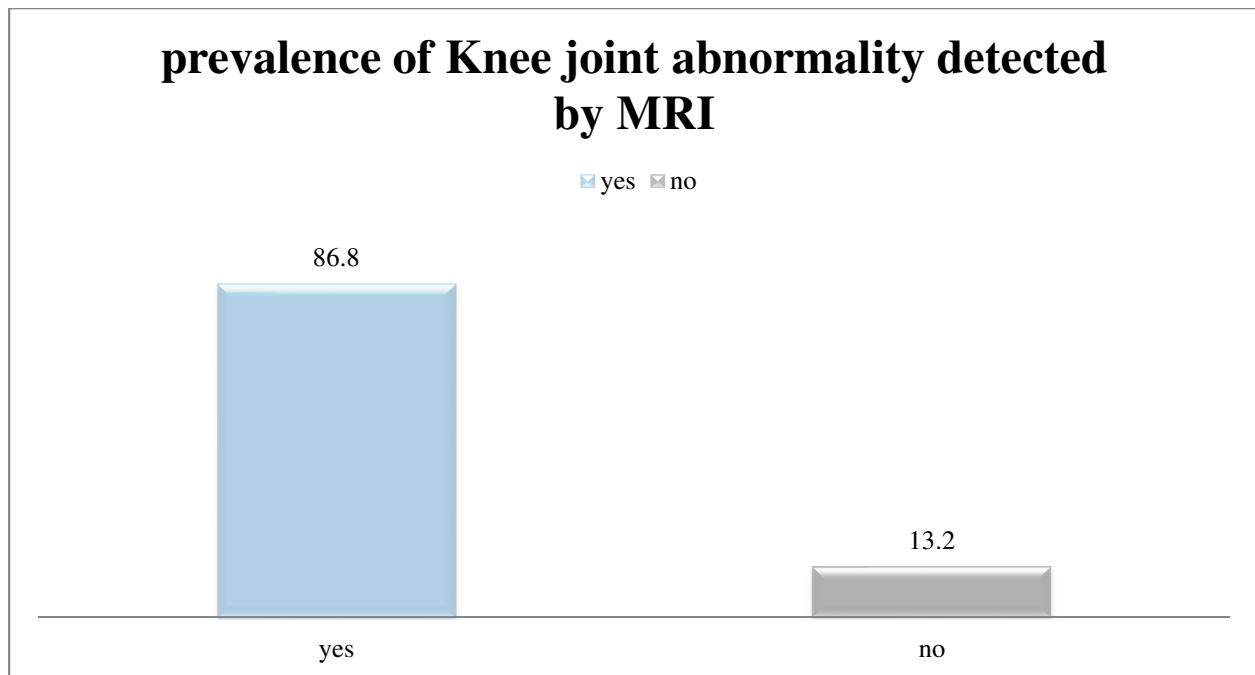


Figure 2 prevalence of knee joint abnormalities detected by magnetic resonance imaging (MRI) among patients evaluated at St. Paul's Millennium Medical College in Addis Ababa, Ethiopia, 2024 (N=204)

5.5. Factors associated with Knee joint abnormality detected by MRI

To find factors associated with knee joint abnormality detected by MRI binary logistic regression was done and four variables with a significant level of $p < 0.1$ were retained for subsequent multivariable logistic regression. After the multivariable logistic regression was done three variables were found statistically significant with $P < 0.05$ (age, hx of trauma, and identified comorbidities).

As result in table 5 shows that patients age < 30 years of age were 0.21 times less likely to develop knee joint abnormality than patients age > 50 years of age. This shows that as age increases the likelihood of manifesting knee injury increases (AOR=0.219 95%CI=0.064-0.742).

Patients with Hx of trauma were 4.3 times more likely to develop knee abnormality than those who don't have Hx of trauma. This shows that the probability of having knee joint abnormality increases with trauma (AOR=4.351 95%CI=1.58-12.009).

Patients with identified comorbidities were 2.17 times more likely to develop knee joint abnormality than those who don't have identified comorbidities. This shows a patient with comorbidities like DM has high probability of having knee joint abnormalities than those who don't have comorbidities (AOR=2.175 95% CI=1.042-7.632).

Table 5: bivariate and multivariate logistics regression analysis of factors associated with knee joint abnormalities detected by knee MRI among patients evaluated at St. Paul's Millennium Medical College in Addis Ababa, Ethiopia, 2024 (N=204)

Variable	Categories	Knee joint abnormality		COR (95% CI)		AOR (95% CI)	
		Yes (%)	No (%)				
Sex	Male	102 (90.3)	11 (9.7)	1.97	(0.86-4.507)*		
	Female	75 (82.4)	16 (17.6)	1			
Age	< 30 year	50 (79.4)	13 (20.6)	0.4	(0.152-0.92)**	0.219	(0.064-0.742)***
	30-50 year	61 (89.7)	7 (10.3)	0.95	(0.28-2.58)	0.414	(0.114-1.388)
	>50 year	66 (90.4)	7 (9.6)	1		1	
Hx of trauma	Yes	98 (94.2)	6 (5.8)	4.34	(1.67-11.27)**	4.351	(1.58-12.009)***
	No	79 (79)	21 (21)	1		1	
Involve in sports	Yes	17 (70.8)	7 (29.2)	0.304	(0.11-0.82)**	0.55	(0.15-1.95)
	No	160 (88.9)	20 (11.1)	1		1	
Identified comorbidity	Yes	108 (89.3)	13 (10.7)	2.03	(1.07-6.514)**	2.175	(1.042-7.632)***
	No	65 (78.3)	18 (21.7)	1		1	

*= P value<0.2 **=P<0.1 ***= P value<0.05

6. DISCUSSION

Magnetic Resonance Imaging (MRI) has emerged as an invaluable diagnostic tool in the evaluation of knee joint abnormalities. Its ability to provide detailed, high-resolution images of the internal structures without the use of ionizing radiation has revolutionized the field of musculoskeletal radiology. [3].

This study assessed the patterns and associated factors of knee joint abnormalities detected by knee MRI in patients evaluated at st Paul's millennium medical college, Addis Ababa, Ethiopia in respective of Sociodemographic characteristics, history of trauma and comorbidities with their MRI findings. According to this study finding, 177 (86.8%) of patients have a knee joint abnormality detected by MRI. In our study, age group >50 years was the most common age group as in other studies conducted in Tikur Anbesa the higher peak age group was 46-60 years [27] but Another paper published in the International Journal of Research in Medical Sciences also reported a peak age of 30-40yrs in their study. This difference could be due to difference in the Sociodemographic characteristic or the delayed health seeking behavior in our study population. This study shows that patients age <30 years of age are 0.21 times (AOR=0.219 95%CI=0.064-0.742) less likely to develop knee joint abnormality than patients age >50 years of age. This shows that as age increases the likelihood of manifesting knee injury increases. This result is consistent with different studies conducted in England, Nigeria, and Ethiopia [5, 25, 26, 27, and 30].

On MRI, we discovered a wide range of disorders in trauma patients, from straightforward bone edema to intricate fractures and from a simple ligament strain to a complete tendon rupture. In this study, we also discovered a range of inflammatory, infectious, metabolic, degenerative, and tumorous diseases.

From patients who have bone fracture, femur was the most common site (57.1%), which is compatible with a study conducted in Nigeria showing femoral abnormality of 46.2% [27]. Joint effusion was the most frequent finding seen in 90 (44.1%) of our patients. Other studies have also shown joint effusion to be the most common finding in knee MRIs like in Nigeria 77.2% [26], and Ethiopia 65.3% [27].

Ligament abnormality occurs in 16.7% of the respondents with ACL tear (55.9%) being the most common type of ligament abnormalities as it was in other studies conducted by Mustafa Z et al reported the frequency of ligament lesions to be 36.8% [32], and other studies conducted in Nigeria and Ethiopia [26, 27]. Meniscal tears were seen in 78 (38.2%) of the patients from those the most common were grade I medial Meniscal tears (53%) and grade I lateral meniscal tear (40.6%) and a similar finding was seen in a study conducted in Addis Ababa Tikur Anbesa [27].

In our study Patients with Hx of trauma are 4.3 times (AOR=4.351 95%CI=1.58-12.009) more likely to develop knee abnormality than those who don't have Hx of trauma, Trauma to the knee, such as a sudden impact or twisting motion, can lead to various types of knee injuries, including ligament sprains, meniscus tears, fractures, and dislocations. These injuries can result in pain, swelling, instability, and functional limitations in the affected knee joint, and Repeated or chronic trauma to the knee joint, such as from sports activities or repetitive stress, can increase the risk of developing overuse injuries, like tendinitis or bursitis. These conditions can cause inflammation, pain, and reduced range of motion in the knee.

Patients with identified comorbidities are 2.17 times (AOR=2.175 95% CI=1.042-7.632) more likely to develop knee joint abnormality than those who don't have identified comorbidities. Comorbidities like diabetes can contribute to the development of knee joint abnormalities, such as osteoarthritis, through various mechanisms. Chronic high blood sugar levels in diabetes can lead to inflammation, oxidative stress, and damage to joint structures, increasing the risk of joint degeneration and cartilage loss in the knee. Individuals with diabetes may experience impaired wound healing and delayed recovery following knee injuries or surgeries. This can complicate the management of knee joint abnormalities and require careful monitoring to prevent complications.

Understanding and addressing the interplay between knee joint abnormalities and comorbidities like diabetes can help healthcare providers deliver comprehensive and effective care to individuals with these overlapping health concerns.

7. CONCLUSION AND RECOMMENDATION

7.1 conclusions

In conclusion, there was high prevalence of knee joint abnormality detected by MRI with major predictor's age, hx of trauma, and presence of identified comorbidities.

From those who have bone fracture the most common site to get injured was femur, and from those who have ligament abnormality ACL tear was the most common in our study. Joint effusion was the most common abnormality detected by MRI followed by cartilage abnormality, osteophyte, and subchondral cyst.

7.2 recommendation

We found that 27 (13.2%) instances of MRI had no knee abnormalities, which is excessive for developing nations with few resources. As a result, we advise hospitals to create clear procedures to make justified use of these costly and scarce resources.

We advise early examination in order to identify these conditions early, given that our health-seeking behavior may be a contributing factor to the longer mean age of our research cohort and the increased frequency of osteoarthritis.

It is not feasible to draw generalizations from the study's limited data; hence further extensive research involving several institutions is recommended in order to do so.

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9. ANNEXES

1. INFORMATION LIST

RESEARCH TITLE:

PATTERNS AND ASSOCIATED FACTORS OF KNEE JOINT ABNORMALITIES
DETECTED BY KNEE MRI IN PATIENTS EVALUATED AT ST PAUL'S
MILLENNIUM MEDICAL COLLEGE, ADDIS ABABA, ETHIOPIA

PRINCIPAL INVESTIGATOR:

Dr Mohammed Adem (Radiology Resident)

Phone number: +251922900257

Email address: mohaadem771@gmail.com

ADVISORS:

Dr. Shewalem Negash (Radiologist, MSK subspecialist)

Bizatu Mengistie (PhD, Associate professor)

SPONSOR:

St. Paul's Hospital Millennium Medical Collage

2. QUESTIONARY

Part one: Socio-demographic characteristics			
Questionnaire code _____			
SN	Questions	Responses	Remark
101	Age in years	1. <10yrs 2. 10-30 3.30-50 4. >50	
102	Sex	1. Male 2. Female	
Part two: Hx of trauma and duration of symptom and comorbidities			
201	Hx of trauma associated with the current compliant	1.Yes 2.No	
202	Duration of symptom	_____ (in days)	
203	Does the patient involve in certain sports or physical activities	1. Yes 2.No	
	If yes specify	_____	
204	Any identified comorbidities	1.Yes 2.No	
	If yes specify	_____	
Part Three: MRI findings			
301	Bone abnormalities	1.Yes 2. No	
302	Is there bone marrow edema	1.Yes 2. No	
	If yes site of edema	1. Femur 2. Tibia 3. Patella	
303	Is there bone fracture	1.Yes 2. No	
	If yes site of bone fracture	1. Femur 2. Tibia 3. Patella	
	Specify any specific type of fracture	_____	
304	Is there soft Tissue Abnormality	1 Yes 2 No	
305	Is there ligament abnormality	1 Yes 2 No	
	If yes type of ligament abnormality	1. ACL tear 2. PCL tear 3. MCL tear 4. LCL tear	
	If ACL tear, specific Type	1. Partial Thickness Tear 2. Full Thickness Tear	

306	Is there meniscal lesion	1. Yes 2. No	
	If yes grade and type	1. Medial meniscus 1.Grade I 2.Grade II 3.Grade III 2 Lateral meniscus 1.Grade I 2.Grade II 3.Grade III	
	If meniscal extrusion, type of meniscus involved	1.Medial meniscus 2.Lateral meniscus	
307	Is there tendon abnormality	1. Yes 2. No	
	If yes, the tendon involved	1. Patellar tendon 2. Quadriceps tendon 3. Other	
308	Is there joint effusion	1. Yes 2. No	
309	Is there osteophyte	1. Yes 2. No	
310	Is there sub-chondral cyst	1. Yes 2. No	
311	Is there an intra-articular mass/tumour	1. Yes 2. No	
	If yes, likely diagnosis	_____	

3. ASSURANCE OF INVESTIGATOR

I the undersigned resident agree to accept all responsibilities for the scientific, ethical and technical conduct of the research project and for provision of required progress reports as per terms and conditions of the Research and Publication Directorate and /or Department of Public Health of St. Paul's Hospital Millennium Medical College.

Name of the Resident: _____

Signature: _____

Date: _____

Approval of Advisors

Name of Public Health Advisor: _____

Signature: _____

Date: _____

Name of clinical advisor _____

Signature: _____

Date: _____